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Demographic correlates of psychotic-like experiences in young Australian adults

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ABSTRACT

Objective: Psychotic-like experiences (PLE) in the general community are common. The aims of this study were to examine the prevalence and demographic correlates of PLE in young adults.

Method: The sample consisted of 2441 subjects aged 18–23 years. Subjects completed the Composite International Diagnostic Interview (CIDI) and the 21-item Peters Delusional Inventory (PDI). Associations between age, gender, hallucinations and delusions were examined using logistic regression.

Results: Both CIDI hallucinations and delusions predicted high scores on the PDI. Younger age was significantly associated with endorsement of CIDI delusions [odds ratio (OR) = 0.66, 95% confidence interval (CI) 0.48–0.92) and with PDI total scores (OR = 0.68, 95% CI 0.55–0.83). Women were significantly more likely to endorse items related to hallucinations (OR = 1.49, 95% CI 1.14–1.95) but not delusions.

Conclusion: PLE are common in young adults. The mechanisms underpinning the age and gender gradients in PLE may provide clues to the pathogenesis of psychotic disorders.

Introduction

Several large population-based studies have reported an unexpectedly high prevalence of psychotic-like experiences (PLE) in the community (1–5). Some have suggested that the psychosis should be modelled on a continuum (5), from those in the community who report the occasional delusion or hallucination to those with disabling symptoms and significant distress. However, before constructing such models, we need a more detailed knowledge of the prevalence and demographic correlates of PLE in the general population.

The first wave of studies that reported on PLE in general population samples relied on psychosis screening items within general diagnostic instruments. For example, the Eastern Baltimore Mental Health Survey (2), using the Composite International Diagnostic Interview (CIDI) (6), reported that 10% of subjects had paranoid beliefs and over four percent of subjects 'heard things that others could not hear'. The Netherlands Mental Health Survey and Incidence Study (NEMESIS) (7) examined 7076 subjects aged 18–64, also used the

CIDI. van Os et al. (5) reported that 17.5% of subjects in NEMESIS endorsed one or more items related to delusional ideas and/or hallucinations. The Australian National Survey of Mental Health and Well Being, which examined delusional experiences in 10 641 adults, reported that 11.7% of the Australian population endorsed at least one psychosis-screening item (8). The National Comorbidity Survey, which examined psychotic symptoms in 5854 adult Americans, found that visual and auditory hallucinations were both frequently endorsed in this general population sample (8.4% and 8.3% respectively) (9). Apart from the CIDI and related general diagnostic instruments, some studies have included instruments specifically designed to assess PLEs in otherwise-well individuals. For example, the Peters Delusional Inventory (PDI) (10), which covers a range of delusional-like experiences, has been used in various clinical settings (11) and general population settings (12). In a general population sample in the United Kingdom (n = 444), over one in four otherwise-well individuals endorsed at least one of the PDI items (13).

Apart from the basic prevalence of PLE in the general community, there is a growing body of evidence about the association of key demographic correlates such as age and gender with PLE. Young adulthood is a critical period during which a range of mental health disorders emerge (14). Congruent with the age of onset of clinical disorders such as schizophrenia (which peaks in both sexes at around age 21 years) (15), population-based studies have shown that PLEs are more frequently reported in young adulthood and decline throughout life (5, 8). Studies based on the PDI have also found that younger individuals are more likely to endorse delusional-like experience (12, 16).

Studies examining the association between gender and psychotic symptoms have produced mixed results. For example, in general population studies using the CIDI, one study reported that females are more likely to endorse PLE (17), whereas another reported that males were more likely to report delusion-like experiences (8). Conversely, there are also reports that delusional ideas are endorsed equally in both sexes (10, 13). Concerning hallucination-like experiences, two studies have reported that females are significantly more likely to endorse these items than females (9, 18).

While there is general agreement that PLE are relatively common in the general community, there is a need for more focused research on the prevalence and demographic correlates of PLE in that segment of the population most at risk for schizophrenia (i.e. young adults). We had the opportunity to examine PLEs as measured by both the PDI and the CIDI in a large general population sample of young adults.

Aims of the study

The aims of this paper were to i) report on the lifetime prevalence and interrelationship of PLE as measured by CIDI G section item endorsement and the PDI and in young adults, and ii) explore the association of age and sex with PLE in young adults.

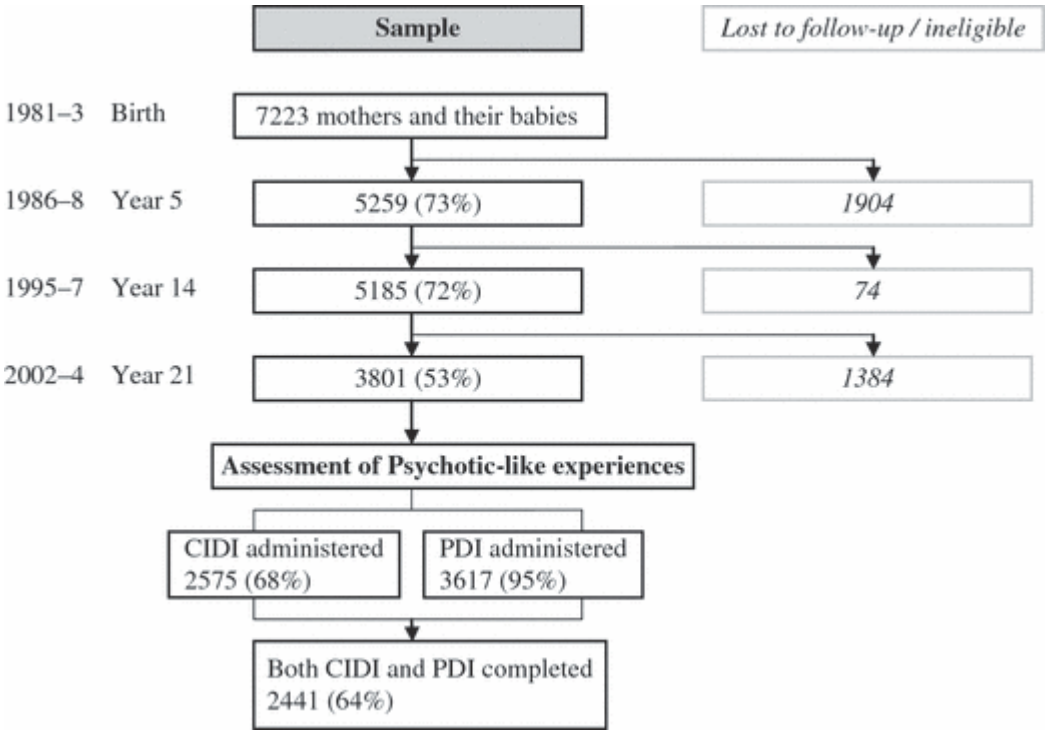
Material and methods

Subjects

The Mater University of Queensland Study of Pregnancy (MUSP) is a prospective longitudinal cohort study of mothers and their offspring who received antenatal care at a major public hospital in Queensland, Australia, between 1981 and 1984 (19). Eight thousand five hundred and fifty-six women were approached on their first antenatal obstetric visit of whom 8458 agreed to participate. Of these, 7631 delivered a live singleton baby at the study hospital and 7223 mothers with their offspring participated in the day 3–5 follow-up. These are the number of subjects at the study baseline. The mothers and the offspring of this birth cohort have been followed prospectively at various intervals (e.g. 5, 14 years) and most recently at 21 years (20). Participation rates and attrition are shown in Fig. 1. At the most recent follow-up 3801 (53%) offspring were assessed, and of these 3617 (95%) completed the PDI. Due to financial constraints, only 2575 of the subjects

assessed at age 21 were interviewed using the lifetime CIDI computerized version 2.1 (21). The psychosis items of the CIDI and the PDI were completed by 2441 subjects (64% of age 21 years follow-up). This group is the focus of the current study.

Fig. 1. Sampling frame and follow-up in the Mater University Study of Pregnancy. CIDI, Composite International Diagnostic Interview; PDI, Peters Delusional Inventory.



Measures

The CIDI was designed as a diagnostic instrument for epidemiological research (22). It is used to diagnose or exclude mental illness in subjects. As a screen to identify individuals likely to have a psychotic disorder, the CIDI includes 17 items for delusions (e.g. 'Have you ever been convinced that you were under the control of some power or force, so that your actions and thoughts were not your own?') and 2 items examining auditory and visual hallucinations (e.g. Have you ever seen something or someone that others who were present could not see – that is, had a vision when you were completely awake?). These are often referred to as G items, because of their CIDI labels (21). The G items have been used in a number of studies for measuring PLE (8, 23). In this study, subjects were asked about PLE throughout their lifetime.

The PDI is based on the Present State Examination (24) and has been used to measure delusional ideation in clinical and community populations (10, 13). It is a 21-item self-report measure. Questions are worded so they are more acceptable to non-clinical subjects, in order to better explore the range of beliefs in community samples. The PDI explores a wide range of beliefs of jealousy ('Are you often worried that your partner may be unfaithful?'), religion ('Do you ever feel as if you have been chosen by God in some way?'), paranormal experiences ('Do you ever think that people can communicate telepathically?') and paranoid ideas ('Do you ever feel as if there is a conspiracy against you?'). Whilst some items explore culturally sanctioned ideas, others may be considered culturally incongruent (e.g. 'Do you ever feel as if you are a robot or zombie without a will of your own?') (10). In this study, the subscales of the PDI were not administered.

Statistics

We used maximum-likelihood logistic regression in order to examine the associations between age, gender and CIDI G item endorsement and total PDI scores. Age was measured as the age of the participant at the time of the interview. Subjects aged between 18 and 20 were compared to those who were 21 to 23 years old. For the purposes of the analysis, subjects who endorsed one or more CIDI G item relating to delusions were compared with those who did not endorse delusions. As a planned sensitivity analysis, we excluded subjects who had a CIDI-derived diagnosis of schizophrenia or other non-affective psychosis.

The total scores of the PDI were divided into quartiles. Using maximum-likelihood logistic regression, we examined the effect of age, gender, positive endorsement of CIDI G item delusions and hallucinations on total PDI quartiles.

A further post hoc analysis was undertaken using the recency measure of the CIDI. Associations with age, gender and total PDI quartiles with 12 month CIDI delusions or hallucinations were examined.

Analyses were performed using sas 9.1 (Cary, NC: SAS Institute). Written informed consent was obtained from the mother at all data collection phases, and from the young adult at the 21-year follow-up. Ethical approval for this study was obtained from the University of Queensland Ethics Committee.

Results

Two thousand four hundred and forty-one subjects completed the PDI and the CIDI G items. There were 1184 males (48.5%) and 1257 females (51.5%). The mean age of subjects was 19.9 years (S.D. 0.87) range 18–23 years.

Two hundred and fifty-five (10.5%) subjects endorsed at least one lifetime G item related to delusions, while 224 (9.2%) subjects reported at least one of the two lifetime G items related to hallucinations. Of those who endorsed a G item related to delusions, 144 (5.9%) endorsed 1 item and 58 (2.4%) endorsed 2 items. Only 53 (2.2%) subjects endorsed 3 or more delusion items. For statistical analyses, subjects were categorised into two groups; those who endorsed one or more G item relating to delusions and those who endorsed no items. With respect to the hallucination items, 181 (7.4%) endorsed the item related to visual hallucinations while 84 (3.4%) endorsed the item related to auditory hallucinations. Forty-one (1.7%) subjects endorsed both auditory and visual hallucinations. Those subjects who endorsed at least one CIDI item related to delusions were nearly five times more likely to also endorse one of the hallucination items [odds ratio (OR) 4.78, 95% confidence interval (CI) 3.43–6.66]. Subjects who endorsed the CIDI item related to auditory hallucinations were over 10 times more likely to also endorse one or more of the CIDI items related to delusions (OR 10.41, 95% CI 6.73–16.13).

While the subjects in this study were drawn from a narrow age band, we noted with interest that items related to delusions were significantly less likely to be endorsed by subjects of slightly older age (OR 0.66, 95% CI 0.48–0.92). This association remained significant after adjusting for the highest level of education achieved (OR 0.65, 95% CI 0.47–0.90). However, there was no association between age and endorsement of CIDI hallucination items. Females were significantly more likely to endorse CIDI hallucination items (OR 1.49, 95% CI 1.14–1.95); however, there was no effect of gender on endorsement of CIDI items related to delusions (Table 1).

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Table 1. Association of age and gender with endorsement of any CIDI G item for delusions and hallucinations

	Any CIDI delusion			Any CIDI hallucination		
	Yes	**No**	**OR (95% CI)**	**Yes**	**No**	**OR (95% CI)**
Sex						
Male (reference)	113 (10.7%)	1113 (89.3%)	1.02 (0.80–1.31)	96 (7.7%)	1150 (92.3%)	1.49 (1.14–1.95)
Female	143 (10.8%)	1169 (89.2%)		145 (11.1%)	1167 (88.9%)	
Age (years)						
18–20 (reference)	226 (11.7%)	1711 (88.3%)	0.66 (0.48–0.92)	178 (9.2%)	1759 (90.8%)	1.10 (0.81–1.50)
21–23	48 (8.0%)	549 (92.0%)		60 (10.0%)	537 (90.0%)	

Significant associations shown in bold. Totals may vary for various measures because of missing data. CIDI, Composite International Diagnostic Interview; OR, odds ratio; CI, confidence interval.

Thirty-six subjects met CIDI criteria for schizophrenia, brief psychotic disorder, schizophreniform disorder or delusional disorder. After excluding these subjects from the analysis, subjects who were older remained less likely to endorse delusions (OR 0.63, 95% CI 0.45–0.89) and females remained more likely to experience hallucinations (OR 1.42, 95% CI 1.08–1.88).

Concerning the PDI, the prevalence of endorsement of individual items varied between 5.5% (item 21: Do you ever feel as if you are a robot or zombie without a will of your own?) and 77.0% (item 3 'Do you ever feel as if some people are not what they seem to be?'). For most items, the percentage endorsements were similar between males and females. There were some items where gender influenced the percentage endorsement. For example, females were more likely to endorse item 9 'Do you ever think that people can communicate telepathically?' (37.7% vs. 24.3%) and item 12 'Do you believe in the power of witchcraft, voodoo or the occult?' (30.5% vs. 19.5%) In contrast, males were more likely to endorse item 6 'Do you ever feel as if you are or destined to be someone very important?' (38.4% vs. 29.3%) and item 10 'Do you ever feel as if electrical devices such as computers can influence the way you think?' (27.9% vs. 21.2%). Concerning the distribution of the total scores (range 0–21), the quartiles divided the subjects into i) two or less, ii) three or four, iii) between 5 and 7, and iv) eight and above.

In keeping with the association between age and CIDI item endorsement, younger subjects were significantly more likely to be in the highest quartile of PDI total scores (Table 1). This association remained significant after adjusting for highest educational level achieved (data not shown). Females were significantly more likely to be in the highest PDI quartile. Those subjects who endorsed lifetime CIDI G hallucination items were nine times more likely to score in the highest PDI quartile (OR 9.04, 95% CI 5.42–15.09). Those who endorsed lifetime CIDI G delusion items were 17 times more likely to be in the highest quartile for PDI total score (OR 17.42, 95% CI 9.93–30.53) (Table 2).

Table 2. Association of age, gender, delusions and hallucinations and total PDI score

	PDI total score			
	Lowest quartile, n (%)	**Second quartile, n (%)**	**Third quartile, n (%)**	**Highest quartile, n (%)**
Age (years)				
18–20 (reference)	464 (71.1)	439 (76.4)	522 (79.2)	440 (79.4)
21–23	189 (28.9)	136 (23.7)	137 (20.8)	114 (20.6)
OR (95% CI)	Reference	0.76 (0.59–0.98)	0.64 (0.50–0.83)	0.64 (0.49–0.83)
Sex				
Male (reference)	350 (53.6%)	268 (46.6%)	304 (46.1%)	262 (47.3%)
Female	303 (46.4%)	307 (53.4%)	355 (53.9%)	292 (52.7%)
OR (95% CI)	Reference	1.32 (1.06–1.66)	1.35 (1.09–1.68)	1.29 (1.03–1.62)
CIDI delusion item endorsement				
Nil (reference)	639 (97.9%)	554 (96.4%)	592 (89.8%)	401 (72.4%)
At least one item	14 (2.1%)	21 (3.7%)	67 (10.2%)	152 (27.6%)
OR (95% CI)	Reference	1.73 (0.87–3.44)	5.17 (2.87–9.29)	17.42 (9.93–30.53)
CIDI hallucination item endorsement				
Nil (reference)	635 (97.2%)	548 (95.3%)	593 (90.0%)	441 (79.6%)
At least one item	18 (2.8%)	27 (4.7%)	66 (10.0%)	113 (20.4%)
OR (95% CI)	Reference	1.74 (0.95–3.19)	3.93 (2.31–6.69)	9.04 (5.42–15.09)

Significant associations shown in bold. PDI, Peters Delusional Inventory; OR, odds ratio; CI, confidence interval; CIDI, Composite International Diagnostic Interview.

A post hoc sensitivity analysis was conducted examining the association of age, gender and total PDI quartiles with subjects who reported experiencing hallucinations or delusions over the past 12 months as measured by the CIDI. Over the previous 12 months, 184 (7.5%) subjects had reported experiencing delusions, 97 reported experiencing visual hallucinations and 54 reported auditory hallucinations as measured by the CIDI. Although the OR remained approximately the same, the loss of power resulted in the negative association between age and delusions (OR 0.72, 95% CI 0.49–1.05) and the positive association between female gender and hallucinations (OR 1.42, 95% CI 0.98–2.05) losing significance. However, the association between subjects reporting delusions over the previous 12 months increased with those who had reported visual hallucinations (OR 18.18, 95% CI 10.35–31.95) or auditory hallucinations (OR 10.93, 95% CI 7.07–16.90) over the previous 12 months. Those subjects who reported experiencing CIDI delusions over the previous 12 months were almost 27 times more likely to score in the highest PDI quartile (OR 26.93, 95% CI 12.38–58.58). The association with those who had experienced auditory hallucinations in the previous 12 months and highest quartile of PDI score also increased (OR 16.88, 95% CI 7.23–39.41).

Discussion

To the best of our knowledge, this is the largest population-based sample examining PLE using the PDI, and the first study to compare the CIDI G items with PDI scores. As measured by the lifetime CIDI, almost 11% and 9.2% of young adults endorsed items related to delusional-like experiences and hallucinations

respectively. Surprisingly, in contrast to the National Comorbidity Survey (9), the item related to visual hallucinations was endorsed more frequently than the item related to auditory hallucinations. Females were more likely to report experiencing hallucinations but not delusional-like experiences. In keeping with other studies (5, 18), we found that those who report hallucinations were also significantly more likely to endorse delusional-like experiences. Remarkably, even though our sample subjects were in an age band of only 5 years, those of younger age were significantly more likely to endorse delusional-like experiences. Subjects of younger age and female gender were more likely to have higher scores on the total PDI. CIDI delusional-like experiences and hallucinations were strongly associated with higher PDI scores.

The prevalence of delusional-like experiences and hallucinations in this cohort is consistent with findings of other large community samples based on a wider range of ages (2, 5, 8, 9). It is now a robust finding that PLE are relatively prevalent in the general community. The clinical significance of PLE is less clear. Whilst one study has shown an association between PLE in children and subsequent psychosis in adulthood (25), longitudinal studies of PLE in adults found an increased risk of affective disorders (26, 27). PLE have also been associated with post-traumatic stress disorder (1) and substance abuse disorders (28). They are more likely to persist if accompanied by depression (3). Whilst some authors have argued that the high prevalence of PLE is evidence of a continuum of psychotic symptoms from PLE to frank psychosis (5, 29), an alternative explanation is that PLE are non-specific symptoms of general distress.

Subjects of younger age were more likely to experience psychotic symptoms and have a higher total PDI score. Whilst the inverse relationship between age and psychotic symptoms has been consistently reported in other studies (5, 8, 13, 30), it is interesting that this negative age correlation was still apparent in the narrow age range examined in this study. Subjects aged between 18 and 20 were significantly more likely to endorse delusions compared with those aged 21–23. Previous hypotheses explaining this relationship when examining PLE across the entire lifespan have included higher rates of cannabis use by young adults and societal influences such as younger subjects having greater exposure to unusual or culturally incongruent ideas such as witchcraft and paranormal experiences through media or Internet (8). In this current study, the age band is so narrow that these explanations are unlikely to account for the more frequent delusional ideation in the younger subjects.

While speculative, it is feasible that the association between delusional ideas and younger age is related to physiological processes underlying brain maturation. Throughout adolescence, there is a relative loss of grey matter from the prefrontal cortex (31). This process is accelerated in the transition from late adolescence to early adulthood (32). Maturation of prefrontal networks in late adolescence is postulated to be responsible for the cognitive, emotional and behavioural changes that occur through this transitional period (33). The relative decrease in delusional ideas that occurred through late adolescence to early adulthood in our study may be a reflection of the physiological maturation of the prefrontal cortex. However, it is also feasible that the younger members of the cohort were exposed to a different mix of psychosocial stressors (e.g. life events related to individuation from the family of origin), which, in turn, may have influenced the endorsement of PLE. As with most developmental processes, mechanisms that integrate the dynamic interaction between psychosocial and neurobiological domains probably underpin the age gradients identified in this study.

The association between gender and psychotic symptoms as measured by the CIDI has varied between studies of different community populations. Just as the inverse relationship between age and psychotic symptoms is now consistently replicated (5, 8, 11, 13), there is robust evidence that females are more likely than males to report hallucinations (9, 18, 34). In fact, this observation was first made over a century ago (35) where 8% of males and 12% of females in a well community sample of 17 000 subjects reported at least one hallucinatory experience in their lifetime. The gender bias of hallucinations in females also applies to morbid conditions. Females with schizophrenia and first episode of psychosis are more likely to report hallucinations than males (36, 37).

In this study, there was no gender association with CIDI G delusion items, but females were more likely to be in the higher quartiles of the total PDI. In contrast to hallucinations, studies examining the association of delusions and gender provide a mixed picture with no consistent association found (8, 10, 13, 18).

The prevalence of psychiatric symptoms and syndromes often differs between the genders. Affective and anxiety disorders are more common in females (38, 39) whilst antisocial behaviours, drug and alcohol abuse are more prevalent in males (40). These differences in psychiatric morbidity may in part be caused by the effects of sex hormones on brain development and functioning (41), and in part by social factors such as learning and gender roles that influence emotions and behaviours. Given the different associations between gender vs. hallucinations and delusions, future studies of PLE should differentiate these symptoms.

In this study, CIDI hallucinations were strongly predictive of CIDI delusions and also of high PDI scores. In keeping with previous studies, hallucinations and delusions tend to co-occur in general population samples (5, 42). As expected, CIDI delusions were also strongly associated with high PDI scores. Previous authors have attempted to explain this clustering of psychotic symptoms. For example, it has been proposed that delusional beliefs arise in individuals in order to explain abnormal perceptual disturbances (43), or that meta-cognitive processes are responsible for both delusions and hallucinations (44). Studies have shown that delusion-prone individuals lack cognitive inhibition. This in turn may be expressed as delusional ideation and misattribution of perceptual experiences (45–47).

The study has several caveats. While the original MUSP birth cohort was representative, not all cohort members were able to be included in the 21 year follow-up. Participants lost to follow-up compared with those who remained in the study were more likely to have been male, have younger mothers, come from families with lower income at baseline and have at least one parent who was a migrant (20). The CIDI was administered by trained interviewers who were not clinicians. The study would have been enhanced if a clinician could have examined the clinical relevance of G item endorsement as undertaken in a previous study (5). Thus the items used are best regarded as measures of subclinical PLE. Finally, for the purposes of this study we have intentionally focused on the cross-sectional effects of age and gender on psychotic symptoms. Future studies will examine the association between other CIDI-derived diagnoses (e.g. depression, substance abuse) and PDI scores and examine the longitudinal course of PLE from adolescence to young adulthood.

In spite of these limitations, we have shown that age and gender have a robust effect on the prevalence of PLE in a community population. The negative correlation between age and delusional-like experiences is apparent even in the very narrow age range encompassing the transition from adolescence to adulthood. Females are more likely to report hallucinations than males. This gender association is less apparent for delusional-like experiences. There are likely to be underlying biological reasons for these associations with PLE. An understanding of the mechanisms underpinning these associations may provide clues as to the aetiopathogenesis and heterogeneous phenotype of psychotic disorders.

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